
Heavy Flavour Production at Fermilab Tevatron

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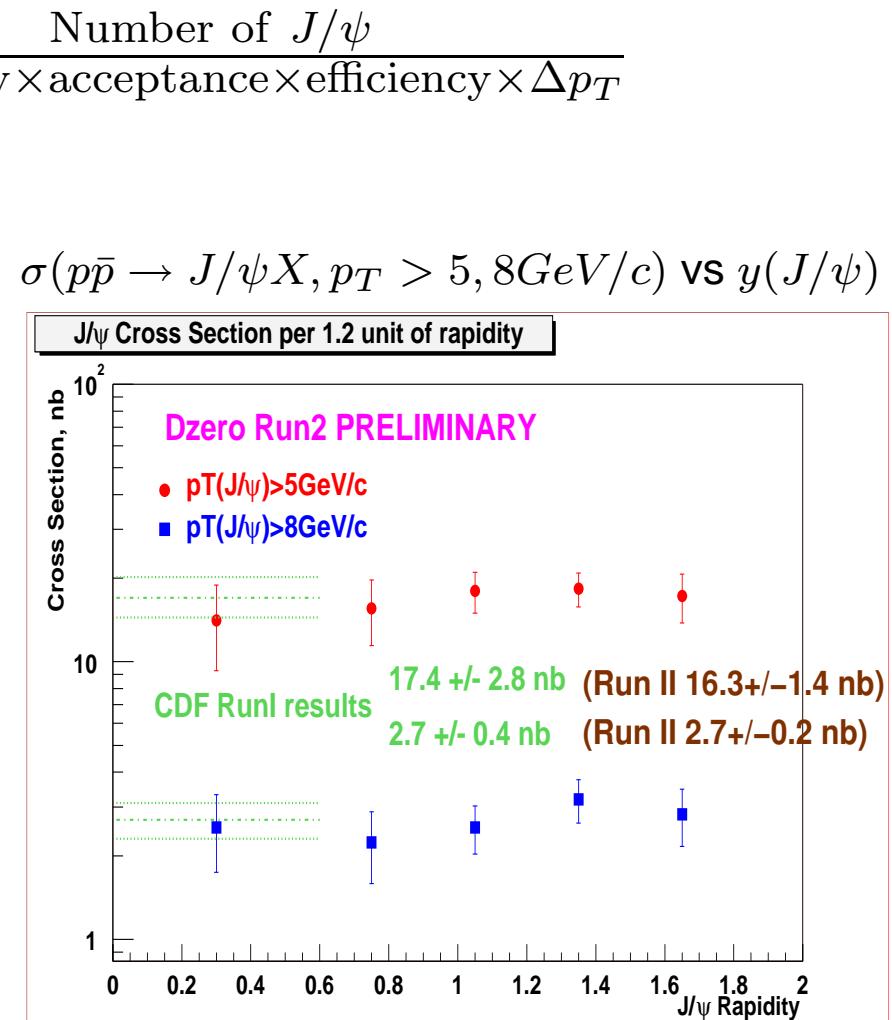
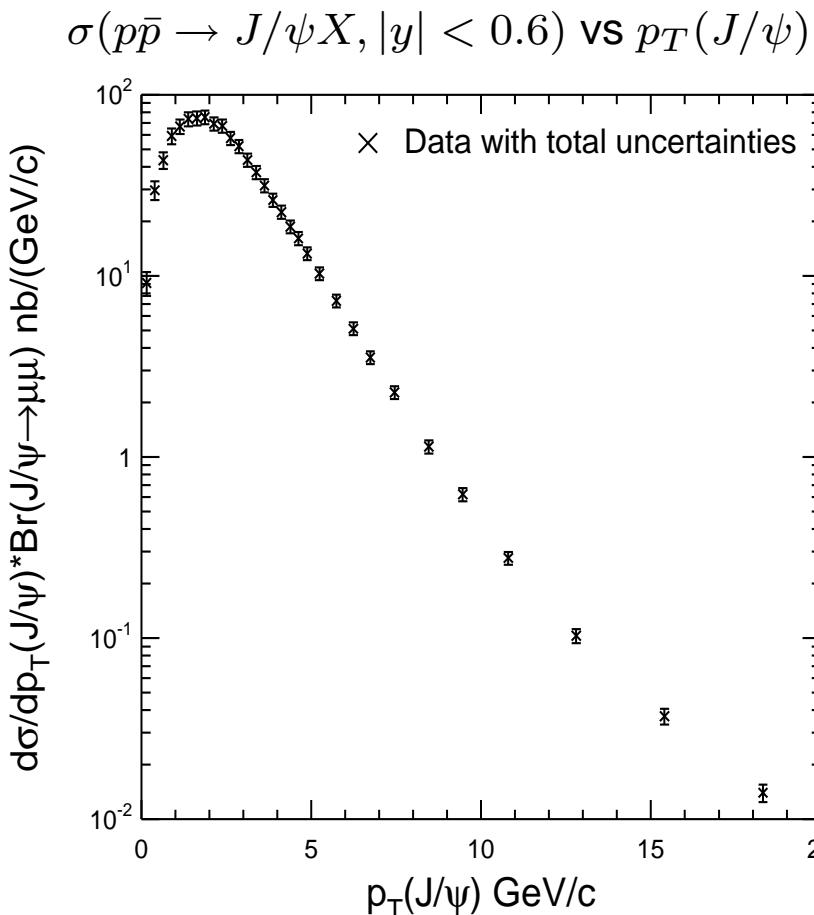
In summer 2001, Run II of the Fermilab Tevatron began. As of December, 2005 more than 1fb^{-1} of $p\bar{p}$ data at $\sqrt{s} = 1.96 \text{ TeV}$ has been collected by both the CDF and D0 detectors. There have been several notable new results in heavy flavour production:

Quarkonia: New measurements of the inclusive J/ψ cross-sections down to $p_T = 0 \text{ GeV/c}$ (CDF) and $|y| < 2.0$ (D0). The new measurement of $\Upsilon(1S)$ cross-sections at $\sqrt(s) = 1.96 \text{ TeV}$ (D0) is found to be in good agreement with the Run I measurements from CDF. The measurement of J/ψ polarization at $\sqrt(s) = 1.96 \text{ TeV}$ by CDF is found to follow the same general trend of increasing longitudinal polarization at high p_T as the Run I measurement and is still in conflict with the COM predictions. Evidence for diffractive production of exclusive $\mu\mu\gamma$ candidates has been observed by CDF.

Charm and Bottom production: The measurement of the central ($|y| < 0.6$) b -hadron cross-sections over all p_T has been performed by CDF and is found to be in good agreement with FONLL calculations. The b -jet cross-sections at $\sqrt(s) = 1.96 \text{ TeV}$ have been measured by CDF and D0 and found to be in good agreement with Pythia LO MC. The $D^{+,0,*}$, D_s differential cross-sections have been measured by CDF and found to be consistent with FONLL calculations.

J/ψ Cross-sections - Run II

$$\frac{d\sigma(p\bar{p} \rightarrow J/\psi X)}{dp_T(J/\psi)} = \frac{\text{Number of } J/\psi}{\text{luminosity} \times \text{acceptance} \times \text{efficiency} \times \Delta p_T}$$



$$\sigma(p\bar{p} \rightarrow J/\psi X, |y(J/\psi)| < 0.6) = 4.08 \pm 0.02(\text{stat})^{+0.60}_{-0.48}(\text{syst}) \mu\text{b}$$

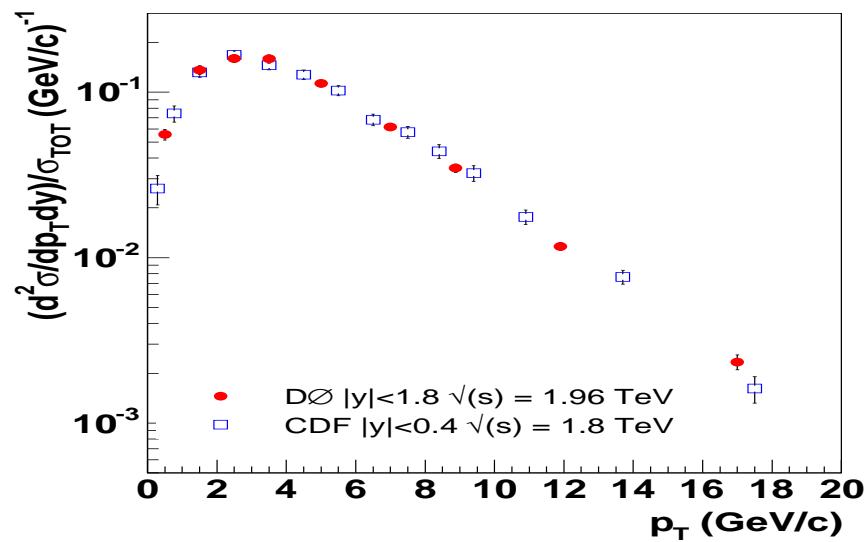
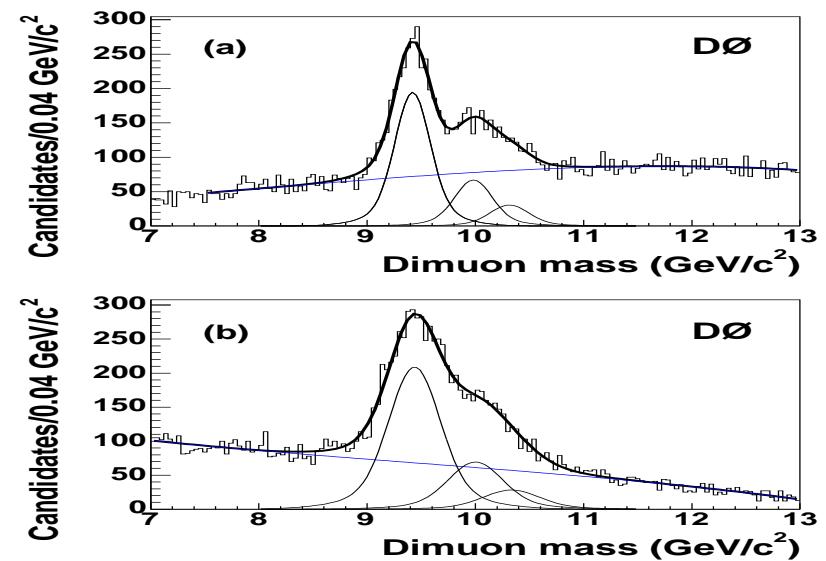
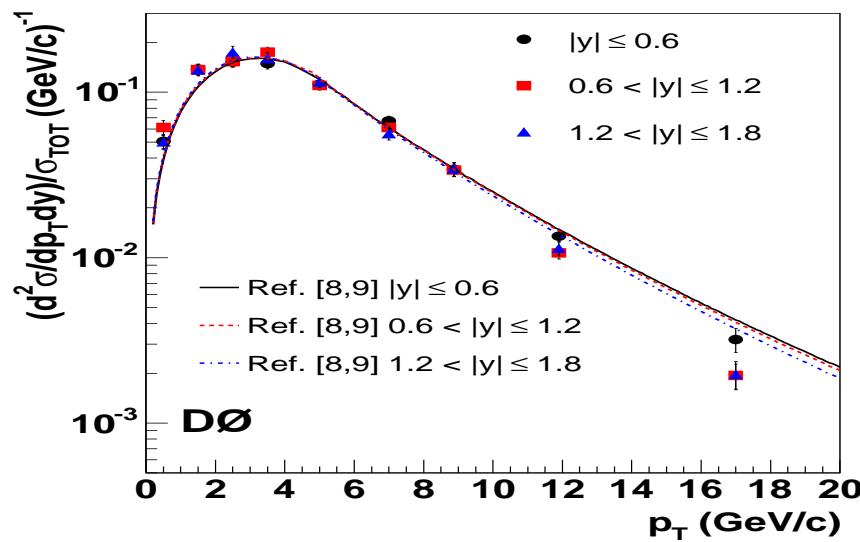
Υ production at $\sqrt{s} = 1.96$ TeV

D0 Run II measurements of the Υ cross-sections from 160 pb^{-1} .

PRL 94, 232001 (2005).

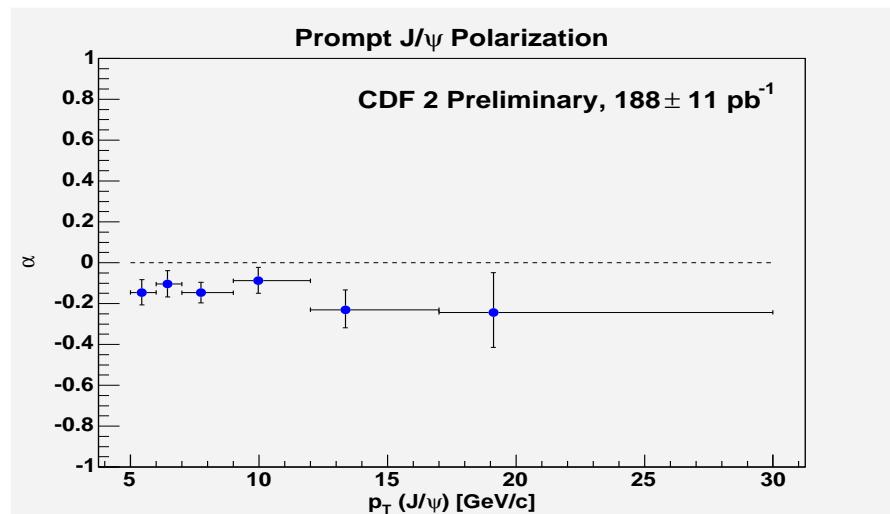
(a) $|y^\Upsilon| \leq 0.6$

(b) $1.2 < |y^\Upsilon| \leq 0.6 < 1.8$

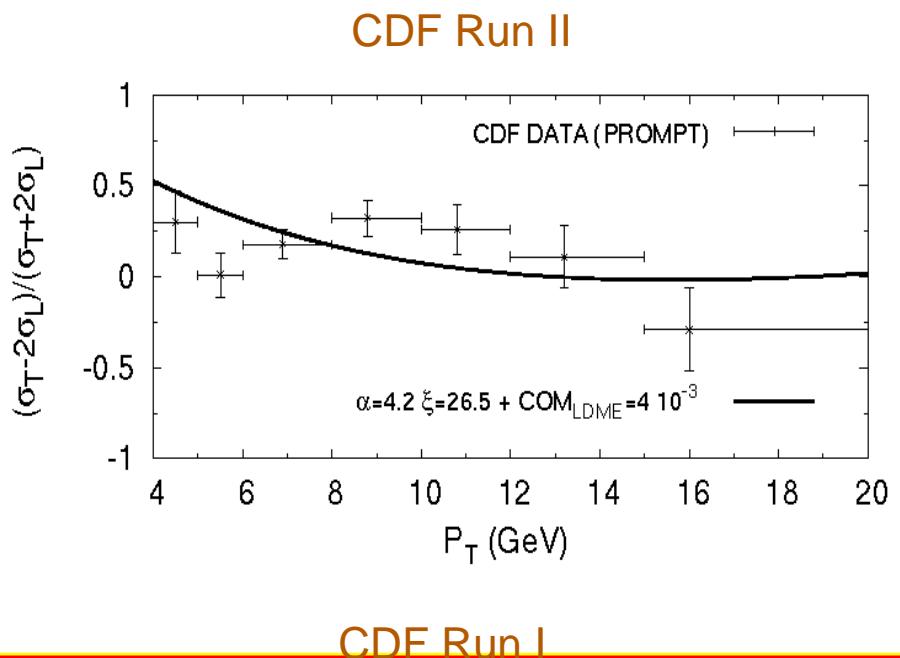


Polarization: new data, theory

CDF Run II measurement of the prompt J/ψ polarization at $\sqrt{s} = 1.96$ TeV. 188 ± 11 pb $^{-1}$. Both Run I and Run II show increasing longitudinal polarization at higher p_T .

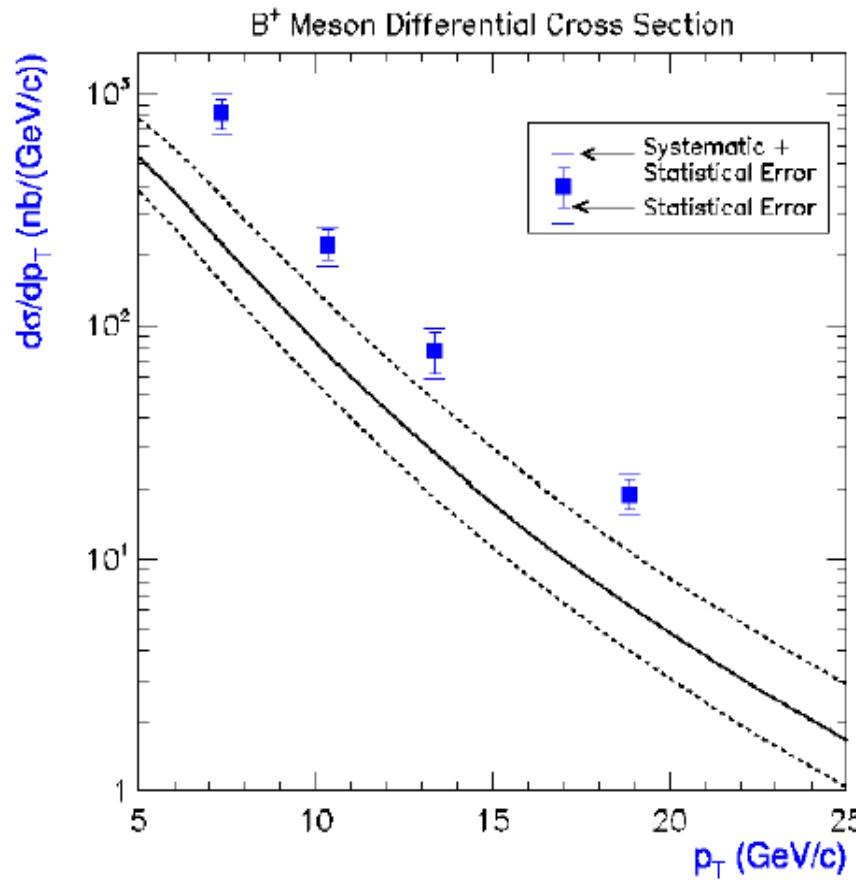


Lansberg, hep-ph/0507175 (July 2005). *Introduced non-static relativistic effects to the hadroproduction of quarkonia \Rightarrow contributions which produce only longitudinally polarized quarkonia.*



b-Production cross-section

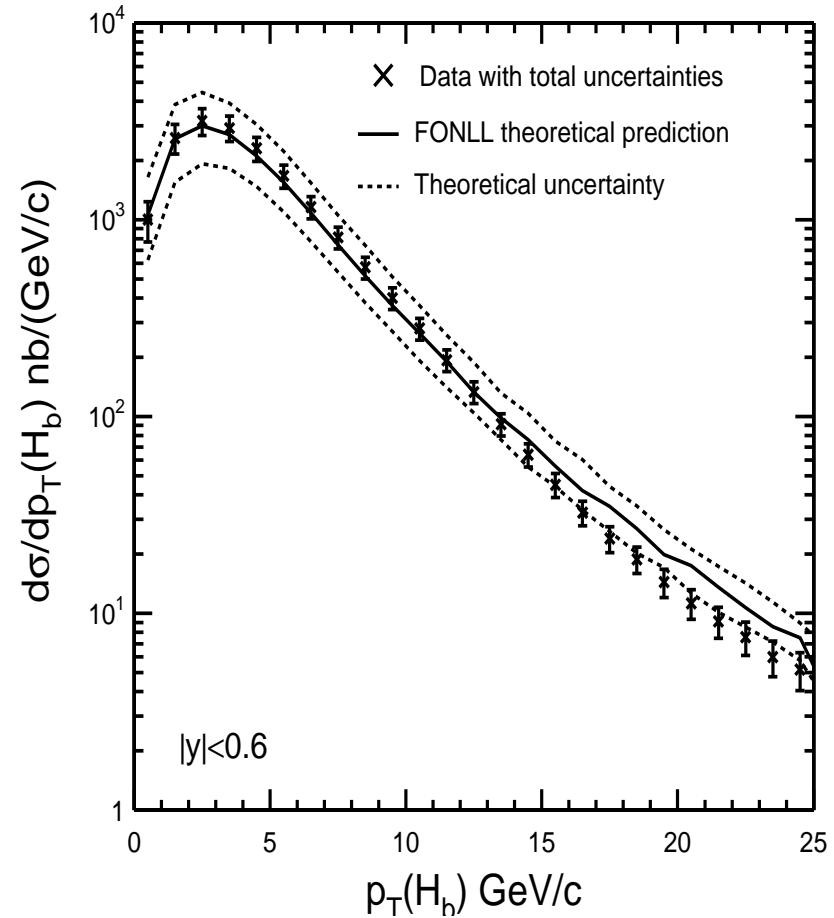
$\sigma(p\bar{p} \rightarrow B^+ X)$ vs $(p_T(B^+))$



1997

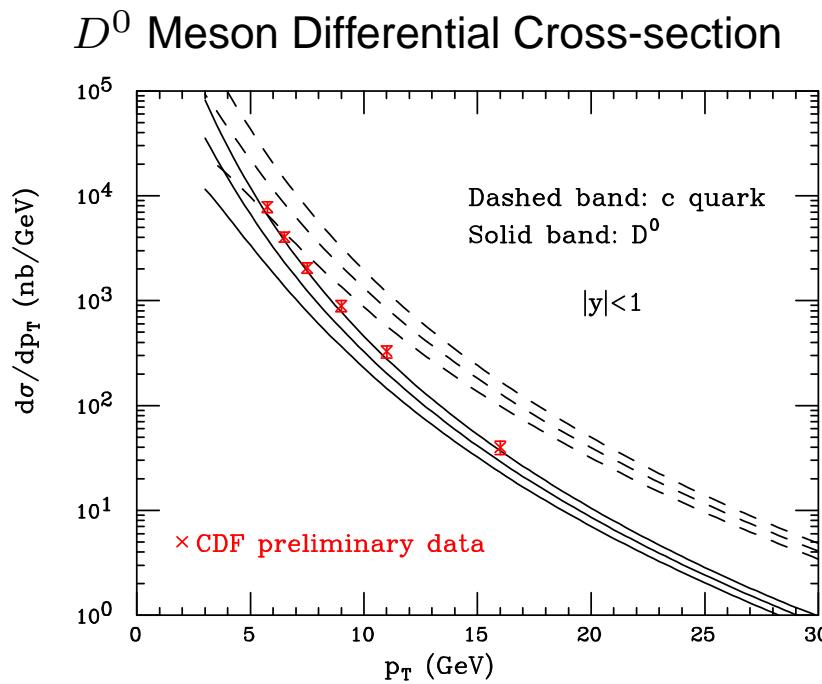
$\sigma_{\text{CDF}} = 17.6 \pm 2.5 \mu\text{b}$, $\sigma_{\text{FONLL}} = 16.8^{+7.0}_{-5.0} \mu\text{b}$ (CTEQ6M, $m_b = 4.75$, $\mu = \mu_0$)

$\sigma(p\bar{p} \rightarrow bx)$ versus $(p_T(H_b))$

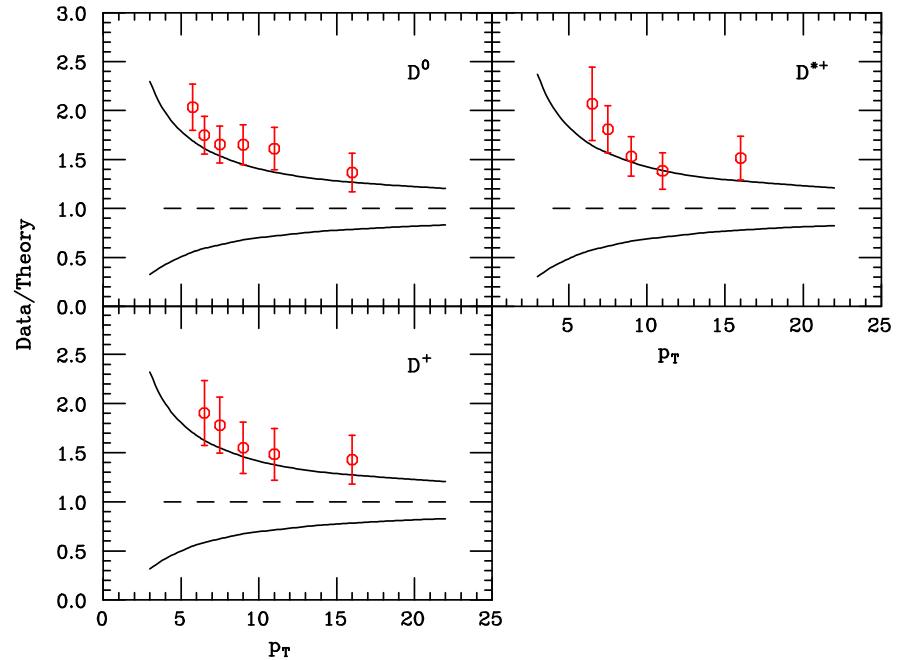


2003

Charm cross-sections



D Meson Cross-sections Data/Theory



M. Cacciari, P. Nason. hep-ph/0306212.

$$\sigma(p\bar{p} \rightarrow D^0 X, |y| < 1.0, p_T > 5.5 \text{ GeV/c}) = 13.3 \pm 0.2(\text{stat}) \pm 1.5(\text{syst}) \mu\text{b}$$

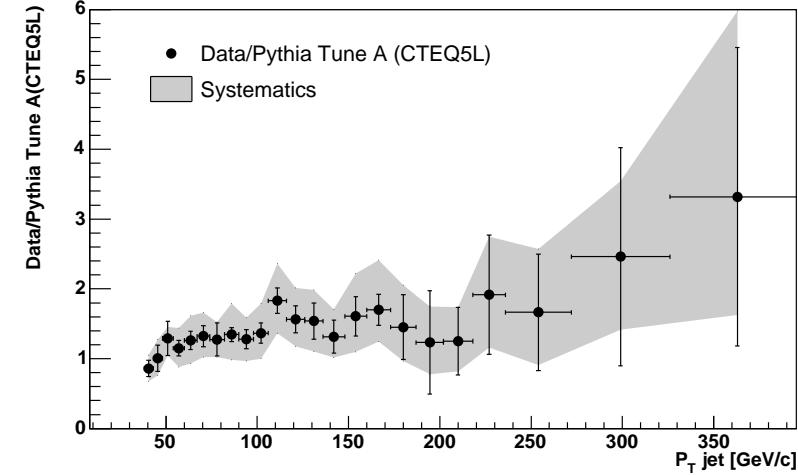
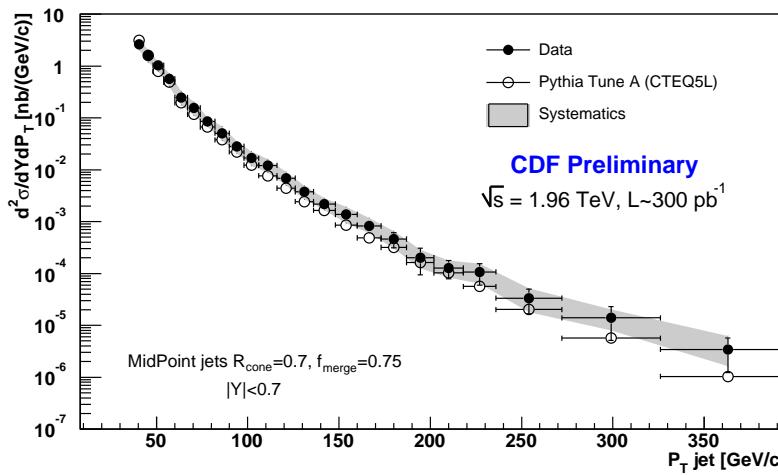
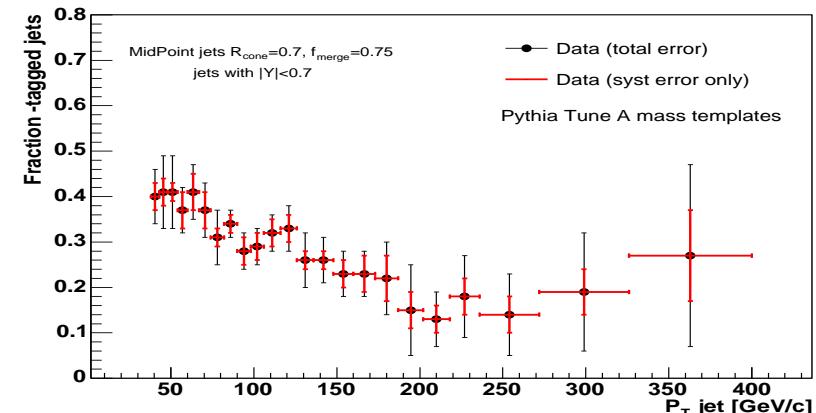
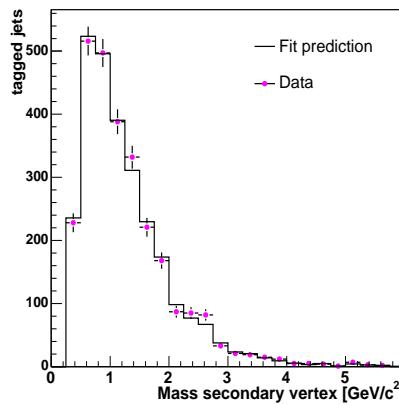
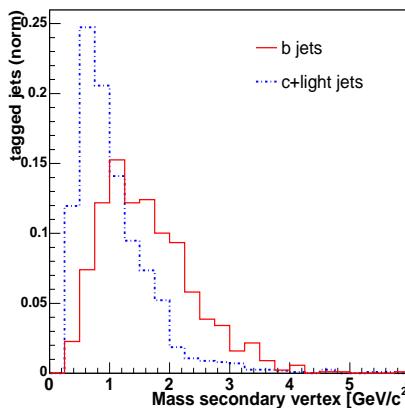
$$\sigma(p\bar{p} \rightarrow D^+ X, |y| < 1.0, p_T > 6.0 \text{ GeV/c}) = 4.3 \pm 0.1(\text{stat}) \pm 0.7(\text{syst}) \mu\text{b}$$

$$\sigma(p\bar{p} \rightarrow D^{*+} X, |y| < 1.0, p_T > 6.0 \text{ GeV/c}) = 5.2 \pm 0.1(\text{stat}) \pm 0.8(\text{syst}) \mu\text{b}$$

$$\sigma(p\bar{p} \rightarrow D_s X, |y| < 1.0, p_T > 8.0 \text{ GeV/c}) = 0.75 \pm 0.05(\text{stat}) \pm 0.22(\text{syst}) \mu\text{b}$$

High p_T b -Jet Production (CDF)

- b/c jet? = fit to the secondary vertex mass:



— b -jet xsecs: good agreement with Pythia (LO QCD) at high p_T .